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ABSTRACT

The term generative phonolgy refers to statements, rules or axioms which can produce all but only those well-formed utterances of a language. The goal of this theory is to make precise and explicit the ability of native speakers to produce utterances of a particular language. In generative phonology, the level of the phoneme is redefined to match the deeper level of abstraction aimed for in the most efficient conception of phonological processes. It is the task of the phonological rules to account for the predictable aspects of pronunciation whether they relate to alternate pronunciations of the same basic morpheme or different phonetic forms that a sound can take. These rules, made to look like "mathematical formulas," provide an explicit means of capturing the general principles of various phonological processes: 1) assimilation, 2) neutralization, 3) deletion, 4) coalescence, 5) epenthesis, and 6) redistribution. The incorporation of distinctive features into a generative phonology allows the linguist to state explicitly important generalizations about the phonology of a language. (PM)

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Generative Phonology: The Basic Model

by

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Generative Phonology: The Basic Model

Introduction

There are inherent dangers in attempting to present introductory notions of a descriptive model in a discipline that has undergone as much change as linguistics has over the past couple of decades. Two decades ago, there was a fairly unified version of "structural grammar" that was, with minor variations, the security blanket for linguistic descriptions. This, of course, was uprooted with the advent of transformational-generative grammar, which challenged many of the tenets held dear by structuralistis in the late 1950's and early 1960's. A fairly unitary version of transformational-generative grammar evolved for a few years during the early and middle 1960's. But this now has all changed as more and more specific details and underlying assumptions of the reigning model have come under question. Although this is more true of grammar than it is of phonology, there is little doubt that many qualifications of earlier interpretation of generative phonology are also in order.

Now this situation presents a dilemma. On the one hand, an honest admission of qualifications that must be made to many of the aspects I would have set forth here a couple of years ago might lead to a somewhat frustrating experience for an audience attempting to grab hold of basic principles characterizing generative phonology. I have seen audiences come away from such honest presentations with a deep sense of despair and an inability to grasp even the most rudimentary principles. On the other hand, a clearcut presentation of unqualified dictums might lead an audience to a false sense of assurance concerning the field. I can still recall my own disillusionment when my second course in linguistics shattered so many of the cherished dictums that I had been quoting from my first course.

It would be nice to reach a middle road between the extremes, but realistically one must choose the side on which he wishes to err. I have (I think) chosen to err on the side of limited qualifications and perhaps can cover myself through occasional footnotes and a general introductory remark that many statements that I make should probably be qualified in some way. I hope that the broad qualifying statement as an introduction, however, does not detract from the observation that there are some very essential underlying principles to be found in looking at phonological systems for a generative perspective.

In a very real sense, the development of generative phonology must be linked with the development of generative grammar. Although it has probably not received as much acclaim as generative types of syntactical analysis, I think it is fair to say that it has changed the way linguists look at sound systems just as significantly as generative viewpoints have affected the way we look at syntax.

What is Generative Phonology?

The initial question asked when confronted with the label "generative phonology" is how one defines such a theory and the way in which it is differentiated from the types of phonological descriptions which were in vogue during the post-Bloomfieldian era of structural linguistics that was popular during the 1940's and 1950's. In a sense, the remainder of this paper will deal with different aspects of this question in terms of detail. But we can preface our discussion by giving a brief introduction to the notion of generative phonology. In using the term generative phonology, we are referring formally to statements, rules, or axioms which can produce all but only those well-formed utterances of a language. The goal of such a theory of the sound structure of language is to make precise and explicit the ability of native speakers to produce utterances of a particular language. As mentioned previously, the viewpoint on phonology must be seen as an application of broader claims that have been laid forth with respect to an overall model of language. As such, it extended the units of analysis beyond the limitations set for a phonology during the era of American structural linguistics. The American structural school as practiced by the followers of the Bloomfieldian tradition was largely concerned with achieving what Chomsky (1964:63) classified as the observational level of adequacy. Observational adequacy is concerned with giving an account of the primary data; that is, segmenting and classifying the units (e.g. the "phonemes" as units in the phonology) of a language. Generative phonology aimed to do more than this, by accounting formally for the competence of the native speaker in his language. A description with the goal of accounting for native speaker intuitions attempts to achieve a level of what Chomsky (1964:64) referred to as descriptive adequacy. And ultimately, a generative phonology must aim at a principled basis, independent of any particular language, for the selection of a descriptively adequate account of any particular language. The ultimate level of adequacy, explanatory adequacy, is consonant with a viewpoint in which linguistic theory is viewed as a special kind of study in psychology in which every capability built into a linguistic theory constitutes a claim that the same capability is built into the language control aspects of the human mind and speech mechanism.

The phonological component of a language model is basically a complex system of rules that apply to a string of elements from syntax and semantics to convert it ultimately to its phonetic form. However, one conceives of the organization of other aspects of an overall language model, at least two (and possibly three) bits of information seem essential before the phonological rules can operate. First of all, there must be some sort of lexical representation in which the basic units of the vocabulary (i.e. the morphemes) are represented in some form. Then there must be some type of syntactic information which is necessary as the input for the phonological rules. In most cases, it appears that the surface output of the syntax is the input for the phonological rules. And in some models, it appears that there is some necessary semantic information as well. The phonological component itself contains rules that can operate on basic lexical representations while taking into account syntactic (and semantic information) in order to arrive ultimately at the phonetic form. Diagrammatically, we may view this as follows:[1]

Lexicon
Grammatical Information
(Semantic Information)

↓

Surface Output of Syntax

↓

Phonological Component

↓

Surface Phonetic Information

For our discussion here, the crucial aspects of the above diagram deal with the nature of the rules that make up the phonological component and the phonological form that the lexical units of the language take. These aspects, as a part of a generative phonology, will be discussed in more detail below.

Lexical Representations

The lexical units of a language are an integral part of any description of a language. One aspect of representing each lexical unit (i.e. morpheme) is its semantic description or meaning. A particular semantic reading is obviously an essential part of the lexical items found in a language. Another aspect of representing the lexical units involves the formulation of syntactic privileges. In other words, a grammar of a language must be able to specify what sorts of units can function as verbs, nouns, etc., in the realization of a grammatical sentence. Still another aspect of the lexicon is the representation of some type of phonological shape for lexical items. That is, each lexical item must have some type of phonetic form. The phonological shape of these units is crucial in understanding how phonological rules operate since it is input for the phonological component. The primary question with respect to the phonological aspects of the lexical units is what type of phonological information must go into these lexical representations. That is, what should the representations or "lexical spellings" look like? This becomes an issue of some importance when we observe that some items which we intuitively feel to be related take more than one form. For example, if we look at an item like electric, we notice, among other changes, the variation between final k and s when a suffix such as -ity is added, giving us electricity. One choice is simply to enter such alternations as a primitive part of the basic lexical item. But if we entered it for an individual item such as electric, then we would be confronted with other items such as elastic, which show the same alternation when -ity is added (i.e. we get elasticity). It does not take astute powers of observation to recognize that we seem to have a regular pattern here, in which certain forms ending in -ic change a final k to s when the suffix -ity is added. What is more impressive is the productivity of this type of pattern by native speakers of English when confronted with items not usually ending in ity. Thus, a native speaker who may never

have been exposed to a form like stoicity from stoic or rubricity from rubric will automatically alternate the final consonant to follow the patterning of electricity and elasticity. As we mentioned previously, a generative phonology must account for the competence of a native speaker of a language in the sounds of his language in a precise and explicit way. In attempting to apply this principle to how we represent lexical items, it seems that the most efficient system would be one which places only unique information into the lexical item and allows general principles of sound organization to account for all predictable variations. In this way, we can account for the underlying sameness of certain units and the generality with which processes effecting change are observed to operate. The lexical spelling or representation for each form should, of course, allow us to most efficiently account for all the necessary changes that will take place. Although some of these units may be one of the alternate forms, this is not a necessary requisite; in some cases, a non-realizable form may most efficiently serve as the unit from which all the variant forms can be most efficiently predicted. The basic form of the lexical entry is sometimes referred to as the underlying representation, since it is elemental unit in the structure from which other forms can be derived. Although there are rather detailed types of motivations for choosing the actual form that the underlying representation should take (and which we shall not go into here), the determination of efficient lexical representations is a cornerstone of generative phonology. In one sense, the notion of underlying representation as distinguished from surface phonetic forms is analogous to the distinction in syntax between deep and surface structure. In this conception, the underlying representation is an abstraction from which the various phonetic forms of an item are eventually derived through the process of applying the various phonological rules.

In structural phonology as practiced in the previous several decades, it was the phoneme which was considered to be the basic unit in phonology. Phonology was seen to be clearly separated from grammar and the phonemes of a language were determined apart from any considerations of grammar. This is not to say that linguists during this period did not recognize that certain alternating forms of morphemes were defined on the basis phonological conditioning, but these alternations were considered to be a special part of the grammar (i.e. morphophonemics). When a phoneme was defined, it was not considered with reference to morphological considerations. And although the phoneme was considered to be an abstraction on one level, phonemes were typically considered to be uniquely realized in terms of one set of phonetic forms. In generative phonology, the level of the phoneme was redefined so that it could match the deeper level of abstraction aimed for in the most efficient conception of phonological processes--one which could account for ALL different types of phonological conditioning found in a language. This redefined notion of the basic unit in phonology has sometimes been referred to as the systematic phoneme in order to distinguish it from the classical level of the phoneme.

The important notion to remember here is that the systematic phonemes are the basic units in the lexical representation and that they are represented in such a way to efficiently allow for all the predictable phonological information to be accounted for by the phonological rules. If phonological information is unique to a lexical item as it is distinguished from the other lexical

items of a language, then it is to be represented; but if it was predictable, then it should not be represented in the basic entry. Thus, the difference between s and k would be represented in items like sill and kill since there is not a predictable process for arriving at the s and the l. It is unique information which is crucial to distinguishing different lexical items. But in forms like electric and electricity and elastic and elasticity the s is predictably derived from k when the suffix is added to the related forms. Hence, the predictable change should not be a part of the lexical spelling of an item. As we shall see in the presentation of Vaughn-Cooke, the notion of lexical representation as presented here has important implications for the most efficient spelling system of English.

Phonological Rules

If the task of the lexical spelling in a language is to give only the unpredictable phonological aspects of each item (i.e. morpheme) in such a way as to most reasonably and naturally account for predictable information, we still need to account for the regular patterning that can predict the needed information in order to arrive at actual pronunciations. This is the job of the phonological rules--to account for the predictable aspects of pronunciation whether they relate to alternate pronunciations of the same basic morpheme or different phonetic forms that a given sound can take. To begin with, there are properties of particular sounds which are implied by others. We know, for example, that English has sounds produced with the tongue in a more backed position such as u and U, and ones in which it is produced with the tongue in a more fronted position such as i and I. As a concomitant of the back sounds, we also know that the lips may be rounded during the production of the sound, but in the production of the front vowels of English, no rounding typically takes place. This, of course, is not true of all languages, since a language like French or German can produce front sounds with a rounding of the lips (e.g. the so-called umlaut sounds). Since the information about rounding is predictable for English is implied by the position of the tongue such information is redundant in the lexical representation for English and therefore to be accounted for by some aspect of phonological rules. Rules which account for this sort of information are referred to as redundancy rules. In this case, the redundancy rules predict some attributes of a sound segment based on the attribute of another property. The significance of this aspect of a phonological description will make more sense when we introduce the notion of distinctive features later in the paper. At this point, it is sufficient to note that certain aspects of an adequate phonological process are needed to account for predictable attributes or properties of a sound unit. In addition to the prediction of certain properties of a sound which are implied by other properties, some aspect of phonology should relate to predictable information about the permissible sound sequences that may occur in a language. For example, if a three consonant sequence occurs at the beginning of a morpheme in English, we know that the first sound in the sequence must be s, the second sound a stop like p, t, or k, and the third sound l or r. This is a regular pattern that any native speaker of English would be able to recognize. Given certain potentially new words in the English language, this principle accounts for the fact that the native

speaker will accept an item like splot or scrat while rejecting items like fplot or snrat as legitimately sounding words in the English language. Rules which account for the placement of redundant information in terms of the sequences of units are sometimes referred to as sequence redundancy rules (as opposed to segment redundancy rules mentioned above) or morpheme structure rules. It is essential to account for this type of information explicitly in a generative phonology since we must account for native speaker's intuitions about the types of permissible sequences of sounds in his language as distinguished from impermissible sequences.

Although the above types of information are ultimately an essential part of a generative phonology, we primarily will be concerned here with another type of rule which accounts for all the predictable changes that take place in phonological units when certain morphemes are combined into words or certain sound sequences are juxtaposed. There is a general principle which is universal in all sound systems: sounds tend to be influenced by their environment. By environment here, we are referring specifically to the influence of neighboring sounds, the position in which a sound occurs in larger units such as a syllable, morpheme, word, phrase or sentence, and the occurrence of certain suprasegmental units such as stress or intonation. Ultimately, the modification of sounds seems to follow natural principles related to physiological or psychological strategies.[2] For example, some of the explanations may be due to the coordination of different muscles within the vocal mechanism. Others may be due to perceptual strategies that take place to optimize differentiation between units for the speaker and hearer to most efficiently make use of language in communication. There are a number of main types of processes which can be delimited in characterizing the types of phonological changes that are found in language. Since this is the essential aspect of the phonological rules, it is therefore instructive to delimitate some of the main processes with illustrations from English. Similar types of illustrations could have been taken from any number of languages. As we shall see in the interpretation of this paper for the role of spelling in English by Vaughn-Cooke, an understanding of these predictable phonological processes must serve as a basis for determining the nature of regular spelling patterns observed in English.

Assimilation

In assimilation, a sound takes on the characteristics of a neighboring sound. A sound may assimilate in several ways. For one, sounds may take on the position point of articulation of a preceding or following sound. Consider the forms of the negative prefix -in in the following items:

indeterminate

indignity

impotent

immaterial

inconclusive

ingratitude

In the above examples, we note that the nasal segment of the prefix tends to change to the point of articulation of the following sound. In the case of a labial sound such as m or p, the pronunciation becomes m as represented in the spelling of m before these items. In the case of k and g, the sound typically becomes an [ŋ], the segment usually represented by the ng spelling of sing. It should be noted here that the speaker of English will automatically pronounce it this way regardless of the fact that it is spelled with an n before a sound produced at the back of the mouth such as k or b.

A sound may also take on a particular manner of articulation from an adjacent sound rather than the point of articulation. For example, if we look at how certain plurals are formed, we can notice the assimilation of the voicing specification in the plural suffix to the preceding sound. Consider the following words:

[kæts][3]	'cats'
[taps]	'tops'
[pæks]	'packs'
[kæbz]	'cabs'
[lɪdz]	'lids'

The above examples illustrate different plural suffixes that are dependent on the voicing of the preceding segment. This aspect of plural formation is but one part of a more general rule for suffix formation in English in which suffixes beginning in a consonant must match the voicing specification of the preceding consonant. This is true for the addition of regular -ed forms as well as the different types of suffixes involving some form of -es suffixation (i.e. plurals, possessives, the third person singular present tense forms). Note how the rule patterns for the -ed forms in the following examples:

[pɪkt]	'picked'
[ræpt]	'rapped'
[pæst]	'passed'
[brægd]	'bragged'
[ræzd]	'razzed'
[ript]	'reaped'

The same general assimilation pattern we observed to operate for plural forms is found to operate for -ed forms as well. Regular assimilation processes such as these are quite productive in English, allowing us to predict how a native speaker of English would form suffixial forms for new items in English. Thus, given some nonsense verb forms like blick, blag, fup, or feb, or some nouns like wuck, wug, stap, or veeb, we would expect the past tense and plural formations respectively to be as follows:

[blɪkt]	'blicked'
[blægd]	'blagged'

[fəpt]	'fupped'
[fEbd]	'febbed'
[wəks]	'wucks'
[wəgz]	'wugs'
[stæps]	'staps'
[wibz]	'weebs'

The formation of these forms simply follows the operating rules of assimilation already learned as a part of the English sound system. And note here that these forms predictably would be pronounced with the application of the assimilation process regardless of the fact that the actual spelling of the forms is consistently -s or -ed.

There are, of course, many different types of assimilation processes, so that consonants assimilating to the point or manner of articulation of an adjacent consonant is simply illustrative of a number of different types of assimilation. Vowels may assimilate attributes of other vowels, or consonants may assimilate certain properties from adjacent vowels. Thus, the change of a final k consonant in items like electric and elastic as described previously involves a process in which k becomes s before a high front vowel of the suffix ity. Before a non-high front vowel such as that occurring in the suffix -al (e.g. electrical) such a change does not take place. The change to s, then, may be viewed as a consonant in the back of the mouth changing to one produced closer to the production of the following vowel. Such types of processes are not at all uncommon in English, as in other languages.

Neutralization

In neutralization, phonological distinctions operating in a language are reduced in certain types of environments. Like other types of phonological processes, the conditioning environment may be related to its position in higher level units (e.g. syllable), contiguous segments, or suprasegmental units such as stress. Basic consonant and vowel contrasts may both be affected. For example, in some dialects of English, the contrast between t and d may be neutralized when occurring between vowels when the following syllable is unstressed. In such cases, a flapped sound may be utilized for both t and d. All of the following items may be pronounced with this flap regardless of whether the underlying form is t or d.

[bæɾə]	'batter'
[bæɾə]	'badder'
[læɾə]	'latter'
[læɾə]	'ladder'

In the case of items like batter and badder, it is quite reasonable to assume that an underlying d exists in badder because of its derivation from bad and an underlying t in batter because of its derivation from bat yet the actual pronunciation of these two items in casual style may be identical.[4] This

particular neutralization is affected by the surrounding environment as it intersects with particular types of stress patterns.

In English, a great deal of neutralization can be observed with reference to vowels. Some of these are peculiar to different regional and social varieties of English while others are found generally in all dialects of American English. In many Southern varieties of English, the vowels I and E are neutralized before nasals like m and n. A Southerner will therefore pronounce pin and pen, tin and ten, and tinder and tender identically. In other types of environments (e.g. as in bit and bet), the contrast between these vowels will still be retained since neutralizations such as these are typically restricted to certain phonological contexts.

One very widespread neutralization of English vowels concerns the reduction of many different vowels to a schwa-like vowel when occurring in unstressed syllables. If we thus take an item like telegraph or photograph, we note that the first syllable receives primary stress, the second syllable is unstressed, and the third syllable secondary stress. These items are usually pronounced something like [tɛ́ləgræ̀f] and [fówtəgræf], so that the schwa-like vowel occurs in the unstressed syllable. But if we add a -y suffix to these items so that the second syllable is now stressed, we get something like [təlégrafì] and [fətágrafì]. Note that the first and third syllable are not unstressed; consequently, they are reduced to schwa. Although there are elaborate rules for assigning stress to effect such vowel neutralizations that have been worked out by Chomsky and Halle (1968) and further refined by Halle (1973), the important point to note here is the systematic process of neutralization in which unstressed vowels become a schwa-like vowel. Again we should note here that these vowels will automatically be neutralized according to the stress patterns and regardless of the underlying lexical spelling of the vowel.

Deletion

In the process of deletion, elements which are posited to exist in the lexical representation of units are lost in particular types of environments. In many cases, deletion processes result in a change of the syllable structure in such a way so as to arrive at more "basic" syllable structures. For example, some processes may delete segments in order to arrive at a simple CV sequence since there is a tendency for languages to prefer such sequences. Deletion processes, then, may break up clusters of consonants and vowels in the direction of these more basic patterns. For example, if we look at the alternation of the indefinite article in standard English, we note that the article a occurs before items beginning with a consonant and an before items beginning with a vowel. By distributing the different forms of the article in this way, we can see how the preferred CV sequence is retained in English, since the distribution prevents the occurrence of CC and VV sequences. If we posit the an as the underlying lexical form, the n can be seen as a deletion process which arrives at the more basic CV pattern.

In English, some of the deletion processes like the above are quite commonly recognized. Thus, the different types of contraction processes which account for items like He's made it, He'd fallen, He'll come and

He'd come seem to be derived through general deletion processes. Under certain relatively unstressed conditions, morpheme-initial segments like h (e.g. have, had) and w (will, would) may be deleted. In a different deletion process the vowel nucleus of these items (which is changed to a schwa-like vowel when unstressed) is also deleted, along with the vowels of other types of auxiliaries such as is and are. This process, then, accounts for forms like He's ugly and You're ugly occurring as contractions along with the previously mentioned items whose underlying forms began with the segments h and w. Although there are a number of details which would have to be considered in a full account of these processes, the well recognized contractions of this type represent important deletion processes taking place in the phonology of English.[5]

While deletion processes of the above types are often recognized on a conscious level by speakers of English, there are other types of deletion processes which take place in casual speech that are sometimes not pointed out. For example, consider the following forms as they may be pronounced in casual conversation by speakers of standard English.

[wEs sayd]	'west side'
[wEst End]	'west end'
[blayn mən]	'blind man'
[blaynd ay]	'blind eye'
[wayl gus]	'wild goose'
[wayld End]	'wild end'

In the above examples, we first note that all the deleted segments consist of the final member of a consonant cluster and the end of a syllable. We further note that the final member of the cluster is only deleted when the following word begins with a consonant. If the following word begins with a vowel, the rule cannot apply. The effect of the rule reduces the number of consecutive consonants so that three successive consonants are reduced to two. Deletion processes of this type are relatively common in a casual style of standard English, even if they are not always recognized overtly.

There are other types of deletion processes that are sometimes not recognized because of a failure to recognize the relationship between derivative forms in the lexicon of a language. In some cases, the alternations between these forms suggest how particular units in the lexicon should be most efficiently represented to allow for the general phonological processes to operate. For example, look at the relationship between the forms given below:

[sayn]	'sign'
[sɪgnəčŬr]	'signature'
[rɪzáyn]	'resign'
[rEZ ɪgnéyšən]	'resignation'

[dɪzaýn] 'design'

[dEzɪgnéyšən] 'designation'

If we recognize that forms like sign and signature, resign and resignation, and design and designation are related in the lexicon of English, we will note that only when a suffix like -ature or -ation is added is the g actually pronounced. If we posit an underlying g in an item like sign, a reasonable postulation because is needed in derivative forms of the item, then it must be deleted when these types of suffixes are not added. When looked at in closer detail, then, certain spellings with so-called "silent" letters of one type or another seem to relate to underlying forms to which various deletion processes have applied.

Coalescence

Coalescence seems to be a specialized type of process which involves both assimilation and reduction. In this process, two or more segments are replaced by one segment that shares characteristics of the original units. A typical case of coalescence in English can be observed in the attachment of the -ion suffix to different forms. Consider the following examples:

[rəbElyən] 'rebellion'

[dəmɪnyən] 'dominion'

[dEmənstreyšən] 'demonstration'

[ərowžən] 'erosion'

[kənfyužən] 'confusion'

In the first three examples, involving lexical items that end in l or n, we note that the suffix contains the palatal y. But in the items ending in t, d, s, and z, the final segment coalesces with the y to form a corresponding palatal fricative, either [š] or [ž], depending on whether the final segment is voiced or voiceless. In the latter case, the segment combines features of both of the original segments while resulting in a segment different from both (i.e. ty → š, sy → š, dy → ž, zy → ž).

A different sort of coalescence involves the double consonants. In this instance, double consonants are coalesced into one segment. In casual speech style, double consonants involved in words like illegal and irresponsible are realized as a unitary segment. In some cases, the coalescence can only operate after operation of other rules which effect assimilation. Thus, when we look at a form like usta, we see first that the original [zd] pronunciation of used assimilates to the voicelessness of the following t in to (i.e. ust ta). This results in double t's. Once this has taken place, the two t's are coalesced into one segment.

Epenthesis

In epenthesis or addition, a sound segment not posited in the lexical representation of items is inserted through a regular phonological process. Epenthesis seems to occur less frequently than a process like deletion, but

it is by no means uncommon. Both vowels and consonants may be inserted in an epenthetical process. One process which a number of linguists consider to be epenthetical involves the formation of plurals in English. In our previous discussion of assimilation, we noted that two different realization of plural, namely [s] and [z] were dependent on the voicing specification of the previous sound segment. But the observations made earlier do not account for all the regular plurals in English. In addition to the forms mentioned previously, there are plurals that insert a vowel between the final consonant and suffix, as illustrated by the following examples.

[bəs ɪz]	'busses'
[rowz ɪz]	'roses'
[d ɪš ɪz]	'dishes'
[mæč ɪz]	'matches'
[ǰəǰ ɪz]	'judges'

In the above examples, we note that the vowel (which may be [ɪ], [ɨ], [ə], or even [E], depending on the dialect of the speaker) is inserted only when the sound to which the suffix attaches itself in a sibilant sound of some type. This includes items like [ǰ] and [č], since phonetically they actually consist of two sound sequences, the final member of which is either [š] or [ž]. From the standpoint of perception, it is quite understandable why this epenthesis might take place since the addition of [s] or [z] to an item already ending in the same sound would end in a doubled or lengthened segment, and this might be difficult to perceive as a plural (e.g. [rowzz] or [bəss]). By adding the vowel, the plural formation is quite clearly marked.

The insertion of the vowel in plurals is part of a more general process which applies when a suffix begins in a consonant quite similar to the one in which the base form ends. Thus, forms that add the -ed suffix indicate a similar type of epenthesis even though the consonant forms involved are quite different. We therefore get the following past tense forms.

[weyf ɪd]	'waited'
[reyf ɪd]	'raided'
[plænt ɪd]	'planted'
[maynd ɪd]	'minded'

If the base form ends in a t or d (i.e. an alveolar stop), then the vowel will be inserted to keep a double t or d from occurring; otherwise, t and d would be added following the assimilation processes described earlier.

There are also some types of consonantal segments which are most adequately accounted for as a type of consonantal insertion. For example, when certain nasals are followed by a consonant, a stop segment matching the point of articulation of the nasal may be inserted. The p in items like contempt and attempt can therefore be accounted for through its insertion following a nasal and preceding another consonant. Similarly, the insertion of b between

m and l in some contexts seems to be a reasonable way to account for items like trembling and humbly as found in the speech of speakers of standard English. The pronunciation of family and chimney as fambly and chimbly respectively by speakers of some nonstandard English varieties can be viewed as an extension of this general epenthetical process.[6]

Sometimes, particular segments can be derived through a process of either deletion or epenthesis, depending on how the form of the lexical representation is postulated. In some cases there are strong arguments in terms of the overall structure of the sound system for choosing one process over the other, while in other cases, reasonable arguments can be made for either interpretation.[7]

Redistribution

Some processes of phonological change involve the redistribution of segments with respect to each other. In one sense, some of the previously mentioned processes such as deletion and epenthesis involve changes which result in the redistribution of different CV sequences. It is also possible, however, to simply change the linear order of segments in a phonological structure by permutations of one type or another. In English, these sorts of reorderings do not appear to be that frequent, although there are several illustrations found in some non-mainstream varieties of American English. When two segments reverse positions, the process is typically known as metathesis. Pronunciations of ask as aks, as is found in some varieties of Vernacular Black English and Appalachian White speech represent such a process. Historically, of course, we know that the older forms of English were aks, so that the metathesis really took place among speakers of standard English varieties where the form changed to ask. The pronunciation of the Biblical name Abednigo as Abendigo involves a metathesis of n and d that can be found among many speakers of standard varieties of English. Nonstandard pronunciations of relevant and revelant involves a type of metathesis that changes the order or non-contiguous consonants. Although the permutation of elements appears to be quite common in the grammatical system of English (e.g. He put the garbage out or He put out the gargage)it is much more restricted in the phonological system.[8]

The Form of Phonological Rules

In the previous sections, we have discussed the status of lexical representations in a generative phonology, the types of rules necessary to arrive at the actual phonetic forms, and the types of phonological processes found in language, as exemplified by English. At this point, we may ask about the form of rules that can capture the various phonological processes that we have discussed. Presumably, there are different sorts of formal conventions that might be utilized in order to capture the various processes, so that the actual formalization is less significant than the actual principles of phonology. Nonetheless, formal conventions that make rules look like "mathematical formulas" can provide an explicit means of capturing the general principles observed in phonological processes. There are several essential aspects which must be captured in any phonological rule in a generative phonology. First of all, there must be an input in terms of basic elements

of the sound system. Ultimately, these elements start with the units in the lexical representations that we discussed earlier. Then, there must be a change to arrive at various alternate forms, the output of a phonological process. And finally, there must be a relevant environment for changes to take place in, since we have already observed the importance of linguistic environment in determining various changes. These facts may be captured in a simple type of convention which takes the form of the following:

$$X \rightarrow Y / A ___ B$$

In such a convention, X is the input for the rule and the arrow indicates that it is changed to or "becomes" Y, the output of the rule. The slant line / indicates that anything beyond that point is relevant environment for the rule to operate. If the relevant environment procedes the sound, then it is placed before the "environmental bar" (i.e. the line ___) and if the following environment is relevant, then it is placed following the bar. In other words, the convention captures a change of AXB → AYB. The processes we described earlier can be formalized by the use of such a convention. Thus, for example, the rule which neutralizes (i.e. changes E to I before a nasal) might be stated like the following. For convenience here, we shall assume that the rule only operates before n, even though we know it can also operate before other nasals.

$$E \rightarrow I / ___ n$$

The rule simply states that E becomes I when followed by the nasal n. Other types of processes such as deletion or epenthesis can also be captured by such conventions. We thus might approximate the rule which deletes underlying g in items like sign something like the following:

$$g \rightarrow \phi / V ___ n\#$$

where ϕ is a null symbol indicating deletion in the context of a preceding vowel and a following n plus a special type of morpheme boundary.[9] More important than the formal conventions for specifying such rules are the particular generalizations in processes that can be captured through the convention. Such rules are written in the form of process statements. That is, we start with a basic unit found in the various lexical representations and process it in various ways in order to eventually end up with the actual pronunciations of the items.

It should be pointed out here that process statements as a descriptive device were not unique to generative grammar. Before the development of generative phonology, there was already an existing tradition in linguistics for describing various forms of a morpheme through what was known as "item and process" descriptions.[10] But there are important ways in which the types of process statements formulated in generative phonology were different from the types of process statements done during the structural period in linguistics. In the first place, there was committment to this type of description inherent within the theoretical view on which the transformational-generative model of language description was based. Previous types of descriptions often appealed to process statements only for the sake of

methodological convenience. Therefore, a justification of the sort, "There seems to be no reason why the linguist should not use whatever method best suits the situation" (Elson and Pickett 1962:46) was considered sufficient. The emphasis on a convenient methodology for segmenting and classifying units was primary in the structural period whereas an explicit theoretical model was given primacy in the developments that took place in generative phonology.

Secondly, the level of abstraction in terms of the basic units of the sound was different in the two conceptions of process descriptions. One of the actually realized forms was considered to be the base in earlier process formulations. As Gleason put it (1961:82) "Select one allomorph of each morpheme as a base form". Generative phonology was allowed to be more abstract so that no such restriction was placed on the base forms. And in the older framework, the distribution of different forms of a morpheme (i.e. allomorphs) that were sensitive to phonological environment were viewed to be an intermediate level which was actually part of the grammatical component of a language at the same time it has obvious relationships to the phonological changes occurring in a language (hence, the term morphophonemics was given to explain this level). In the structural conception of language model, the phonology was to be clearly separated from the grammar of a language, and justifications of various units was to be made without reference to other levels of language such as grammar. In terms of the phonology itself, the phoneme was the primary unit and changes in phonemes that interacted with the different forms of a morpheme were somewhat out of place in the phonological level of a language description. In generative phonology, the basic unit in the phonology was more abstract, and all phonological changes, regardless of their sensitivity to morphological variation, were considered to be an appropriate aspect of the phonological rules of a language.

The third important difference between earlier process types of descriptions and those found in generative phonology relates to the notion of rule ordering. As various phonological processes were looked at in relation to each other, it became apparent that a perfectly concise and explicit model of phonology would have to order at least some of the rules with reference to each other in order to arrive at the actual phonetic forms. By ordering here we are referring to the placement of rules in a particular sequence so that one rule operates after another one. A number of processes we described earlier have to be ordered with respect to other rules in order to arrive at the actual phonetic forms. For example, in order to allow certain non-schwa vowels to reduce to schwa, we first have to have a bloc of rules which move the stress from a vowel in order for it to reduce to schwa. In items like telegraph and photograph, the stress placement that moves the primary stress to the second syllable with the addition of the -y suffix (e.g. telegraphy and photography) must take place before the vowel in the first syllable can be reduced to a schwa-like vowel. And we already alluded to the fact that the rule reducing consonant doubling in an item like usta from used to we must first have a rule which changes the original d in used to t. If we arrange the rules in this way, we can have a quite general rule which affects a great many double consonants.

To illustrate further, consider the pronunciations of plural forms of desk and test as desses and tesses, well-known forms found among speakers of

of Vernacular Black English and some White Appalachian varieties of English. The derivation of plural forms such as these can best be understood by looking at the ordered sequence between various rules operating on these forms. If we assume that we start out with lexical representations or underlying forms such as dEsk and tEst, we first note that there is a rule that deletes the final member of the cluster, resulting in dEs and tEs respectively.[11] Then the regular plural rules that appear to operate on all varieties of English take place. This means that any noun ending in a sibilant-type sound (i.e. [s], [z], [š], and [ž]) will appropriately have a vowel inserted between the final s-like consonant and the plural form [z]. The third rule changes the voiced segment z to s if it follows a voiceless segment. The rule sequence is set up as follows:

	Underlying Form	tEst+z	dEsk+z
Rule 1.	Consonant Cluster Reduction	tEs+z	dEs+z
Rule 2.	Epenthetic Vowel	tEs+ɪz	dEs+ɪz
Rule 3.	Assimilation of z Plural to Preceding Voiceless Segment	Not Applicable	Not Applicable

By setting up the rules in this sequence, the regular rule for plural formation can be seen to operate in Vernacular Black English in much the same manner as it operates for other varieties of English. The particular plural form is different because the consonant cluster reduction rule has operated prior to the plural rules, thus leaving a final s-like sound for the epenthetic vowel to be inserted between the final s and the z form of the plural. But consider what would happen if the plural rules and the consonant cluster reduction rules were reversed in their application.

	Underlying Form	tEst+z	dEsk+z
Rule 1.	Epenthetic Vowel	Not Applicable	Not Applicable
Rule 2.	Assimilation of z Plural to Preceding Voiceless Segment	tEst+s	dEsk+s
Rule 3.	Consonant Cluster Reduction	tEs+s	dEs+s

In the above order (which appears to be how many speakers of standard varieties of English actually pronounce desks and tests in rapid speech style) we could not account for the phonetic forms of the Vernacular Black English speaker in a natural way. Note that the epenthetical vowel rule can not operate before the consonant cluster reduction rule, because it does not meet the environmental conditions for the rule to operate (i.e. it does not end in an s-like sound). The only way in which we could account for the form if we ordered the rules as stated above would be to have another rule similar to the original epenthetic vowel rule. To have two rules that are identical does not appear to be economical, especially since the same

generalizations can be captured by ordering the rules in the way that we previously specified. Concise and explicit rules that are at least sometimes ordered with respect to each other, then, is an essential aspect of accounting for the phonetic forms in the process formulation.[12] Formal rules in generative phonology, then, take the form of a series of explicit process statements in which the input of any rule in the series operates on the output of previously applied rules, if they have met the conditions for operation (1. A → B, 2. B → C, 3. C → D, etc.). If a given unit does not meet the conditions for operation (i.e. the relevant environment or the input) then the rules are by-passed until the conditions for operation are met.

Distinctive Features

In the preceding sections, we have only considered the contrastive units in a language in terms of the various sound segments of the phonological system. In some approaches to phonology, units such as phonemes are considered to be the smallest contrastive unit in the phonology. This means that if we wanted to specify a rule that changed I to E before nasal sounds m, n, and ŋ, we would have to specify the rule something like the following:

$$1 \rightarrow E \; / \; __ \; \begin{Bmatrix} m \\ n \\ ŋ \end{Bmatrix}$$

While this certainly accounts for the data accurately, there seems to be an important generalization that is not formally handled in this process: namely, that all but only nasal segments can effect the change. While this generalization is certainly implicit in the series of sounds that are included as the relevant linguistic context for the operation of the rule, there is no explicit way in which this generalization is captured. Now a preferred model of language description is one in which such generalizations can be handled in a concise and explicit manner. In order to do this, we must admit that significant units of a phonological description are further divisible into certain properties of sounds. If we therefore look at the series listed above in terms of the properties or features of the class of sounds, we observe that a single property unifies this set while excluding all other sound segments from the class; namely, the feature of nasality. If the sounds are then divided into various properties, all we really have to do is capture the general nature of the feature. If we do this by simply specifying the property something like [+nasal], we have explicitly captured the significance of the class of sounds that effect this particular rule. Three different segments can be represented then by the formal reference to one property that uniquely characterizes the set. One can see how the breakdown of units on such a basis can lead to more parsimonous explicit statements of phonology. Similarly, we can take the various attributes of the process of a rule and capture the generalizations in terms of the segmental units affected by the rule. Thus, the consonant cluster reduction rule we specified earlier (i.e. where the final member of word-final consonant

cluster may be deleted) can be observed to operate on final consonants such as t, d, k, g, p, and b, but not clusters involving s, z, s, z, etc. The process aspect of the rule taking the contrastive segmental units of the language as basic would have to look something like:

$$\left\{\begin{matrix} t \\ d \\ k \\ g \\ p \\ b \end{matrix}\right\} \rightarrow \emptyset \; / \; \ldots \quad [13]$$

Now it is quite clear that these sounds are unified by the fact that they are all stop or non-continuant sounds (i.e. there is a complete obstruction of the oral mechanism in the production of the sound). This might be captured generally by referring to this property of the sounds, which we might characterize as [+stop] or [-continuant]. The generalization, then can be stated simply by a rule that utilizes this common property, such as:

$$[+\text{stop}] \rightarrow \emptyset$$

The justification for appealing to a level of phonology in which the ultimate unit of the phonological system is the phonological feature is based on several important observations, all of which are interrelated. As we have observed above, it allows for more economical descriptions of phonological processes and environments in formalizing the rules. In place of a simple listing of the sound segments, we can often state the same observation through the use of a more restricted number of features. The reason we can do this is based on a more essential principle--that the appeal to phonetic features captures important generalities that are observed in phonological processes. Phonological processes do not randomly select from the inventory of sound segments of a language, not do they operate in linguistic environments where the relevant sounds for the operation of a process is random. Rather, there is a systematic articulatory or acoustic basis for particular processes taking place as they do. The appeal to phonetic components or features of sounds allows us to explicitly and concisely state the regular generalizations that are observed to take place. It stands to reason that a theory that can account for unifying generalities in a natural way should be considered superior to one that cannot. Classes of sounds that are uniquely unified on the basis of their shared features are referred to as natural classes. We have already alluded to the fact that a division of sounds on the basis of their features allows us to specify sets that have an internal relationship to each other. In a natural class of sounds, fewer features can be used to specify the class of sounds that can be used to specify any individual member of the set. Features, then, provide a principled basis for defining what constitutes a natural class of sounds in a language. And we already observed above that natural classes of sounds are essential in understanding how phonological systems are organized.

Because the goals of a generative model of language involve a concise and explicit formulation of phonological processes, one can see how the notion of phonological features as the primitive units of phonology would

naturally fit into the theory. This, of course, is not to suggest that phonological features of this type were not utilized to some extent in traditional phonological descriptions. Earlier work on distinctive features by Jakobson (e.g. Jakobson, Fant and Halle 1952) and others had been incorporated to some extent into phonological descriptions a couple of decades before the advent of generative phonology. But while they were incorporated into phonological analyses in many traditional studies, the traditional phoneme offer was still often considered to be the central unit of phonology, not the distinctive feature. In generative phonology, features were formally admitted as the central distinctive unit of the system.

Ultimately, the theory of distinctive features is established on a restricted universal set of phonetic features that are adequate for describing the phonological contrasts and processes of any spoken language, although not all features might be relevant as contrastive properties in a particular language. While this notion is generally agreed on by generative phonologists, determining the most efficient set of universal features for doing this task is still not settled. Some earlier formulations following Jakobson's work appealed to the acoustic parameters of speech as the basis for a universal system whereas more recent formulations have relied more heavily on the articulatory aspects of sounds.

Features may refer to major sound classes (e.g. consonant, sonorant), manner of articulation (e.g. continuant, nasal), place of articulation (e.g. anterior), or even suprasegmental aspects (e.g. stress, tone). In some cases, features refer to the simple presence of absence of a particular characteristic, such as nasality, voicing, or the involvement/non-involvement of the tip or blade of the tongue (i.e. corona). In other instances, + or - values reflect the extreme points of a feature that actually range over a continuum, such as the various points of articulation that may be utilized in the mouth. The use of features must effectively and naturally distinguish the significant segmental sound units (which may be individual in terms of actual production) as they contrast with each other. Hence the term distinctive feature. The +/- values are referred to rather than degrees of individual features in explicitly showing the contrastive phonological units of a language and the processes that change these units in different ways.[14]

Following is a listing and definition of features that appear to be relevant for the description of the English sound system, and a matrix of the significant sound segments in terms of these features (primarily from Chomsky and Halle 1968).

Consonantal - Consonantal Sounds are produced with constriction along the center line of the oral cavity. The only sounds non-consonantal in English are the vowels and glides w, h, and y.

Syllabic - Syllabic refers to the role of a sound in the syllable. Segments that constitute a syllabic peak are considered to be syllabic while those not constituting a peak are non-syllabic. Typically, the vowels are syllabic and the consonants, other than certain semi-vowels and semi-consonants, are non-syllabic.

For the most part, the following set only applies to consonants:

Anterior - Anterior sounds are produced with obstruction located in front of or at the alveolar ridge of the mouth. Thus, labial, dental and alveolar sounds are anterior and palatal and velar sounds are non-anterior.

Coronal - Coronal sounds are produced with the front (tip or blade) of the tongue. Sounds that are produced with another part of the tongue (e.g. back) or not involving the tongue (e.g. labials such as p and m) are non-coronal.

Continuant - Continuants are characterized by continued air movement through the oral cavity during the production of the sound. Non-continuants are produced with complete obstruction in the oral cavity. The qualification of oral cavity is important in order to consider nasals such as m and n as non-continuants since the oral cavity in nasals is completely obstructed while the nasal cavity is open for the duration of the sound.

Strident - Strident sounds are produced with an obstruction in the oral cavity that allows air to come through a relatively long, narrow construction. As the air escapes, the turbulence produces the primary noise source over the rough surface. Most, but not all of the sounds traditionally classified as fricatives (θ and ð being the exceptions) are considered to be strident and other sounds are non-strident.

Sonorant - Sonorant sounds are typically produced with a lesser degree of cavity construction. Vowels, nasals, and liquids are typically considered sonorants while sounds with more radical cavity constriction such as stops (e.g. p, t, k) and fricatives (e.g. s, f, v) are typically considered non-sonorants.

Voice - Voiced sounds are produced with a vibration of the vocal bands in the larynx and voiceless ones are produced without such vibration. Sounds like t, p, s, and š are voiceless while sounds like d, b, z, and ž are voiced.

Nasal - Nasal sounds are characterized by the lowering or opening of the velum so that air can escape through the nasal passage. Non-nasal sounds are produced with the velum closed so that air can only escape through the oral cavity.

For the most part, the following features are used with reference to the classification of vowels, semi-vowels, and semi-consonants.

High - High vowels involve the raising of the tongue from the neutral position, involving a relatively narrow construction in the oral cavity. Vowels like i, I, u, and U are considered to be high vowels and those produced with a lower tongue position are all considered non-high.

Low - Low vowels are produced with a lowering of the tongue from a neutral position. (The vowel approximately in the position of E in bed is typically considered the neutral position.) Vowels such as æ, a and ɔ are considered to be low vowels. Note that in this system mid-vowels like e, E or o are distinguished by being both non-high and non-low.

Back - Back sounds are classified as being produced with the tongue backed from the neutral position. If it is produced at or in front of the neutral position, it is considered to be non-back. Thus, vowels like i and e are considered non-back vowels while vowels like u, o, and ɔ are considered to be back.

Round - Sounds produced with a rounding of the lips are considered to be rounded. Vowels like u, o, and ɔ in English are rounded while the other vowels of English are typically unrounded.

Tense - Tense sounds are produced with a de iberate, maximally distinct gesture that involves considerable muscular activity. Non-tense sounds are produced with a lesser degree of muscle activity so that they are more indistinct. Vowels like i and u are considered to be tense in contrast to their counterparts I and U, which are considered to be non-tense.

	p	b	t	d	k	g	č	ǰ	f	v	θ	ð	s	z	š	ž	m	n	ŋ	r	l	h	y	w
cons	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-
syll	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-
continuant	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-	+	+	+	+	+
nasal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-
anterior	+	+	+	+	-	-	-	-	+	+	+	+	+	+	-	-	+	+	-	-	+	-	-	-
coronal	-	-	+	+	-	-	+	+	-	-	+	+	+	+	+	+	-	+	-	+	+	-	-	-
high	-	-	-	-	+	+	+	+	-	-	-	-	-	-	+	+	-	-	+	-	-	-	+	+
low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
back	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+
voice	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	+	+	+	+	+	-	+	+
strident	-	-	-	-	-	-	+	+	+	+	-	-	+	+	+	+	-	-	-	-	-	-	-	-
sonorant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+

True Vowels*

	i	I	e	E	æ	u	U	o	ə	a	
cons	-	-	-	-	-	-	-	-	-	-	-
syll	+	+	+	+	+	+	+	+	+	+	+
high	+	+	-	-	-	+	+	-	-	-	-
low	-	-	-	-	+	-	-	-	-	+	+
back	-	-	-	-	-	+	+	+	+	+	+
tense	+	-	+	-	-	+	-	+	-	-	-
round	-	-	-	-	-	+	+	+	-	-	+

*For the true vowels we have eliminated the features that appear to be distinguishable mainly for consonants.

Although the matrix given above represents the various features that are considered distinctive in English, it is noted that, for particular sounds, some of the features are predictable on the basis of other features. Thus, for example, a whole set of features needed for consonants are completely predictable for the vowels. In the most economical statement, these implied features are thus redundant. For example, in English if we know that a sound is characterized by being [-back], such as i or I, it is predictable that it must be [-round] as well, since only back vowels are rounded. Similarly, if we know that a consonant sound is [+nasal] in English, we also know that it must be [-strident], [+continuant], and [+nasal]. When the values of features are completely predictable on the basis of the values of other features for a particular sound, we refer to them as redundant features. The significance of redundant features in a generative phonology is that the model is committed to a principle of economy in which only non-predictable information is to be included in representing the basic units and processes in phonology. All predictable information is derived through the various types of rules we discussed earlier in this paper. Some redundancies may be specific to a particular language (such as the prediction of rounding on the basis backness in English but not in all languages) while others appear to be universal (such as the prediction of [-low] for all [+high] vowels).

To summarize the importance of distinctive features, we first of all see that they serve as a universal basis for describing the phonetic components of the sound systems of language. On a more abstract level, they operate to differentiate the various lexical items of a language, since they are the smallest contrastive units in the phonological system. And finally, their incorporation into a generative phonology allows us to state explicitly important generalizations about the phonological processes of a language, as defined on the basis of natural classes of sounds.

In the preceding presentation, I have attempted to present some of the preliminary notions concerning a generative phonology. As we have seen, such an approach attempts to account for what a speaker-hearer knows about the structure of his sound system. This includes information starting with the abstract units in the lexical representation and going through to the actual pronunciation of items. Generative phonology attempts to capture the generalizations on the various levels in an explicit and concise way. While some of the details of formulation will certainly be revised or abandoned as we increase our knowledge of sound systems, it seems obvious that the optimal approach to the symbols on a printed page is one that will take greatest advantage of the awesome knowledge that a speaker-hearer has of his own sound system.

Footnotes

1. I have purposely tried (but not completely succeeded) to avoid committing myself here to a model that shows the relationship between syntax and semantics. This is a crucial issue in current linguistic theory that presumably will be discussed in other articles in this collection.

2. The delimitations of these natural principles is one of the areas in which linguists are most actively pursuing at this point in the study of phonology.

3. All the transcriptions throughout this paper represent broad phonetic transcription and are not intended to include phonetic details irrelevant to our discussion.

4. There are other dialects of English which distinguish these words by the length of the preceding vowel. In some of these cases, the contrast between t and d may be neutralized, but the vowel length keeps the words from being homophonous.

5. For more complete details concerning the actual deletion processes that account for contraction in English, the interested reader should consult Zwicky (1970) and relevant sections of Labov (1969).

6. For details on the actual conditions under which this epenthetical process can take place, see Bailey (1973:227).

7. The case of the [əz] plural is a case at point here. Some linguists maintain that the basic lexical representation should be [əz] and that [ə] should be deleted, whereas others make a case for considering the [ə] to be epenthetical. Ultimately, such differences by the naturalness with which it accounts for the data and the efficiency in terms of how the rules deriving the various forms are arrived at.

8. We should be careful here to distinguish between regular metathesized segments that are part of the rules of a particular variety of English and metathesis as a reflection of a performance factor of some type (i.e. a "slip of the tongue"). It is well-documented (cf. Fromkin, 1971) that many types of performance errors as well as certain pathological speech conditions are characterized by metathesis.

9. The "special" type of morpheme boundary is needed here in order to allow the rule to operate when a suffix like plural is added (e.g. [saynz]) while prohibiting it from operating when a suffix like -ature is added (e.g. [sɪgnəčUr]).

10. Compare Hockett's (1953) classic article on different types of processes utilized in grammatical description. As Hockett points out in his article, item and process types of descriptions were actually older than distributional statements following the tradition of what has been labeled "item and arrange-

ment" (i.e. the simple description of elements in terms of their distributional occurrence with other elements). And while item and process statements were utilized to describe the occurrence of some phonologically conditioned variants of a morpheme, the description of the phonemes of a language during the structural period were typically confined to item and arrangement types of statements.

11. For a justification of dEsk and tEst as the underlying forms in these varieties, see Fasold (1969) or Wolfram (1970).

12. The discussion of rule ordering here should not be interpreted to mean that there is no controversy about the role of rule ordering in generative phonology. As it turns out, there is presently a considerable amount of controversy over the extent of ordering (i.e. are the rules completely or partially ordered) and the principles that govern the ordering of rules. There is one group of linguists currently that feels that all ordering can be predicted on the basis of universal principles while others maintain that some orderings are quite language or dialect-specific. For the former position, see Koutsoudas (1972); for a response to this claim in terms of the rules of English dialects, see Bailey (1973).

13. There are actually more details to this rule than those specified here but we have eliminated them for the sake of demonstrating the principle at hand here. For more complete information on how this rule operates in dialects such as standard English and Vernacular Black English, see Wolfram (1969) and Fasold (1972).

14. Although most description in generative phonology still utilize only binary features, there is considerable debate about the empirical and theoretical validity of binary features at least on some levels of the phonological system.

References

Bailey, Charles-James N. 1973. "Variation Resulting from Different Rule Orderings in English Phonology", in Charles-James N. Bailey and Roger W. Shuy, eds., New Ways of Analyzing Variation in English. Washington, D. C.: Georgetown University Press.

Chomsky, Noam. 1964. "Current Issues in Linguistic Theory", in Jerry A. Fodor and Jerrald Katz, eds., The Structure of Language: Readings in the Philosophy of Language. Englewood Cliffs: Prentice-Hall.

_____ and Morris Halle. 1968. The Sound Pattern of English. New York: Harper and Row.

Elson, Benjamin and Velma Pickett. 1962. An Introduction to Morphology and Syntax. Santa Ana: Summer Institute of Linguistics.

Fasold, Ralph W. 1969b. "Orthography in Reading Materials for Black English Speaking Children", in Teaching Black Children to Read, ed. by Joan C. Baratz and Roger W. Shuy. Washington, D. C.: Center for Applied Linguistics.

_____ 1972a. Tense Marking in Black English: A Linguistic and Social Analysis. Washington, D. C.: Center for Applied Linguistics.

Fromkin, Victoria A. 1971. "The Non-Anomalous Nature of Anomalous Utterances", Language 47:27-52.

Gleason, H. A. 1961. An Introduction to Descriptive Linguistics. New York: Holt, Rinehart and Winston.

Halle, Morris. 1964. "One the Bases of Phonology", in Jerry A. Fodor and Jerrold J. Katz, eds., The Structure of Language: Readings in the Philosophy of Language. Englewood Cliffs: Prentice-Hall.

_____ 1973. "Stress Rules in English: A New Version", Linguistic Inquiry 4:451-464.

Hockett, Charles. 1954. "Two Models of Grammatical Description", Word 10:210-234.

Jakobson, Roman, Gunner Fant, and Morris Halle. 1952. Preliminaries to Speech Analysis: The Distinctive Features of Their Correlates, Cambridge: MIT Press.

Koutsoudas, Andreas. 1972. "The Strict Order Falacy". Language 48:88-96.

Labov, William. 1969. "Contraction, Deletion, and Inherent Variability of the English Copula". Language 45:715-762.

Wolfram, Walt. 1969. A Sociolinguistic Description of Detroit Negro Speech. Washington, D. C.: Center for Applied Linguistics.

_____ 1970. "Underlying Representations in Black English Phonology", Language Sciences April: 7-12.

Zwicky, Arnold. 1970. "Auxiliary Reduction in English". Linguistic Inquiry 1:323-336.